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# Do Socio-psychological Factors Matter in Agroforestry Planning? Lessons from Smallholder Traditional Agroforestry Systems

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Most of the well planned rural development forestry programs of the 1970s, and agroforestry in particular, were either not adopted by the intended beneficiaries or failed to meet the needs and aspirations of the rural people, particularly in the developing countries. The reasons for non-adoption in some cases appear to be technical, bio-physical, social and economic (termed as rational reasons by the planners), but in other situations the reasons are not so easily recognisable and comprehended (termed irrational reasons). These irrational reasons are the perceptions and attitude of the farmer towards farm practices, and their role in agroforestry planning has remained almost completely neglected. The present study is based on a household survey of the farmers in traditional agroforestry systems of Western Himalaya and investigates the importance of perceptional and attitudinal aspects of the farmers with regard to agroforestry adoption and extension. In the present study, farmers' perceptions of restrictions on felling of trees from their own land and attitudes towards agroforestry were the most important socio-psychological factors which influenced tree growing. This study implies a need to take into account the socio-psychological factors of the farmers for planning socially acceptable agroforestry programs. The importance of study of various *de jure* rules and regulations controlling the use of on-farm tree resources and related exemptions and their association with farmers' perceptions and tree growing is highlighted to develop policies to encourage tree growing in agroforestry.

**Keywords:** agroforestry, perceptions, attitudes, forestry adoption, tree growing

## INTRODUCTION

Perceptions and attitudes form the socio-psychological variables of the adopting units, and if the innovation or farm practice conforms to perceptions (perceived needs and problems) and attitudes of the adopting unit then it is easily adopted (Lionberger 1960, Raintree 1983, Rogers 1995). For instance, farmers may not be motivated to incorporate trees on their farms for tree products if there is no perceived shortage of tree products, even if there is severe deforestation. Rural people are often familiar with tree growing but have differing attitudes towards trees and these attitudes can affect tree growing on farms (Wiersum 1984). An *attitude* is a tendency to respond in a specific way when confronted with particular stimuli (Oppenheim 1992). It is presumed that any idea, innovation or farm practice is easily adopted if there is a positive attitude towards the practice; otherwise it is not adopted. In the past, community forestry programs were not accepted by the rural populations whom they were intended to help (Lovelace 1985). Rural people see the world differently from those who design the interventions.

Little is known about farmers' perceptions of trees, tree products and related aspects compared to what is known about their perceptions of agricultural crops and practices (Arnold and Dewees 1999). *Perception* is an awareness that emerges as a result of a complicated weighing process an individual goes through as their mind takes into account a whole host of factors and cues (Cantril 1968). Perception is a function of the situational fields within which an individual operates (Rogers 1995). For instance, the physical presence or absence of forests near a village can influence local farmers' perceptions of the shortage of tree products even if the farmers are not actually deriving any tree product from the forests. There are many studies on the impact of farmers' socio-psychological variables towards the adoption of new agricultural technologies (Boahene *et al*. 1999, Sall *et al*. 2000) and soil conservation technologies to enhance agricultural yield (Ervin and Ervin 1982, Black and Reeve 1993, Baidu-Forson 1999, Beedell and Rehman 2000, Degrande and Duguma 2000, Leary *et al.* 2000), but there is still a gap in the understanding of how these factors influence the motivation of farmers to grow trees in agroforestry systems. The perceptions of the local people are important in the development of agroforestry programs (Akbar *et al.* 2000). A valuable approach in developing agroforestry is to utilise the perceptions of the local population with regard to trees and forests (Brokensha *et al*. 1980, cited in Wiersum 1984).

Most previous studies on agricultural innovation or technological adoption have been criticised for only studying the incidence of adoption and not the extent of adoption (Feder *et al*. 1985). Therefore, for the present study, incidence of on-farm tree growing (growing or not growing) as well the extent of its adoption (number of trees per farm) are studied. This paper examines the association between the tree growing (incidence and extent of tree growing) and farmers' socio-psychological factors (perceptions, attitudes and awareness of the sources of tree seedlings). With regard to policy implications, the importance of socio-psychological variables in designing socially acceptable agroforestry programs and models is outlined.[1]

[1] The term agroforestry is used here as synonymous with farm forestry, and includes all systems of timber tree growing on farms.

## DATA COLLECTION

The philosophical perspective to data collection in this study is that an essential pre-requisite for any successful planning is knowledge – knowledge of what is, of what can be and of how it is (Malya 1964). The best way to learn about local conditions and people's perceptions is to ask people, in which the interviewer seeks to learn from farmers or key informants about land-use practices and the reasons for their adoption (Fox 1990). Conducting surveys is one of the most frequently used methods in social science research (Chambers 1993). Surveys have been widely used in India in the past to collect information on forest resource use, joint forest management, social forestry adoption and attitude of forest users (Mahapatra 1997, Gupta 1999, Sood *et al*. 2000, Glendinning *et al*. 2001). Other qualitative methods of data collection and a rich repertoire of interviewing has now developed in Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) to complement the data from surveys (Chambers 1983, 1993). RRA differs from PRA in that the former is used by an outsider conducting research in an area whereas the latter is more commonly applied by local people, sometimes in conjunction with outsiders.

Since the household is the decision-making unit regarding growing trees on its own farm (retaining natural growing trees and or planting trees), primary data were collected by surveying the heads of household in the study area. The study was carried out in Mandi district of Himachal Pradesh (India) located in the Indian Western Himalaya. Traditional agroforestry systems are practiced by the farmers of the district. This district is situated between $31^{o}$ 13' 50" and $32^{o}$ 04' 30" north latitude and $76^{o}$-37'-20" and $77^{o}$-23'-15" east longitude (Balokhra 1999). The total geographical area of Mandi district is 3950 $km^2$, with a tree cover of 1539 $km^2$ (FSI 1999). Almost all the forests in the district are State owned and local farmers have recorded rights to collect timber, fuel, fodder and forest products from these forests for their domestic needs. Because 25% of the population of this district is illiterate, it was decided to collect data on a prestructured questionnaire through face-to-face interviews with the heads of households.

### Questionnaire Design, Pilot Survey and Field Work

After a review of the literature and discussions with project supervisors, a draft questionnaire was developed, which sought information on perceptions of the households about various aspects of forests and agroforestry. There were five attitude statements to develop attitude scores of the farmers on agroforestry. These attitude statements concerned influences of agroforestry on domestic wood needs, household income, insect pest and diseases, soil erosion and soil fertility, respectively. A three-point Likert scale was used. In positive statements the values for responses – agree, undecided and disagree were 3, 2 and 1 respectively, whereas for negative statements responses of agree, undecided and disagree were scored as 1, 2 and 3 respectively. The values of each answer for five statements were added to obtain an attitude score for each respondent. Questions were also included on demographic profile and forest resource use of the householders. Mock interviews were conducted with colleagues to learn how long interviews would take and how the questions would be interpreted by respondents. The questionnaire was discussed with a few farmers in the study area and with experts in forestry and agriculture,

both in the State Forest Department and at the University of Horticulture and Forestry, Himachal Pradesh.

A pilot survey was carried out in the village of Chaugan in Mandi district, using a random sample of 25 households. One of the six attitude statements was dropped because it revealed poor correlation with attitude score minus statement score.

Group discussions were held with key informants to prepare the village profile. This also helped in establishing good rapport with the villagers and learning about the reasons for different perceptions held by the farmers. Household data were collected from each of the sampled villages by personal interview during August 2001 to May 2002.

**The Multistage Sampling Approach**

Multistage sampling was used to select households (Figure 1). Mandi district was chosen for the present study. It was therefore considered appropriate to take these forest divisions as sampling units in the first stage. As hills impose a set of constraints and opportunities that differ from foothills, Joginder Nagar and Suket Forest Divisions were purposively selected as they contained both hills and foothills. The villages were categorised into hill and foothill villages with the help of divisional forestry staff of each selected forest division. Each of these categories was further stratified into: Joint Forest Management (JFM) and non-JFM villages. Two villages from each stratum (JFM and non-JFM) for hill and foothill villages were chosen in each of the two selected forest divisions using simple random sampling. In this way, there were eight sample villages in each selected forest division and 16 villages in total (Figure 2).

Next, the farmers in each selected village were stratified in two categories: small and large farmers. Economically privileged groups own more than 1 ha of land and there is a preponderance of small (≤1 ha) landholders in the State (GOHP 1987). The farmers having large holdings (>1 ha) represent large farmers. Since data on number of households in each village were not available, a list of households in each of the selected villages was prepared by employing data collectors. Total landholding size of each household was also recorded during this pilot survey. Finally, one-third of households were taken as the sample from large and small farmers for each selected village. The total sample size was 401 households.

**Data Compilation and Statistical Analysis**

Data compilation involved the coding of data and data entry on computer through Statistical Package for Social Scientists (SPSS) 11.0 for MS Windows. There were two dependent variables for multivariate analysis, viz. incidence of agroforestry adoption (type of grower) and extent of agroforestry adoption (number of trees per farm).

The dependent variable, type of grower (*tree grower* and *non-grower*) is categorical. Farmers were categorised as tree growers if they had at least one tree on their farm, and non-tree growers otherwise. Most explanatory variables in the householder's perceptions are categorical, nominal or ordinal. The main form of analysis employed is the Chi-square test of independence of classification. Chi-square testing is a bivariate analysis for nominal by nominal and nominal by ordinal variables (Bryman 2001).

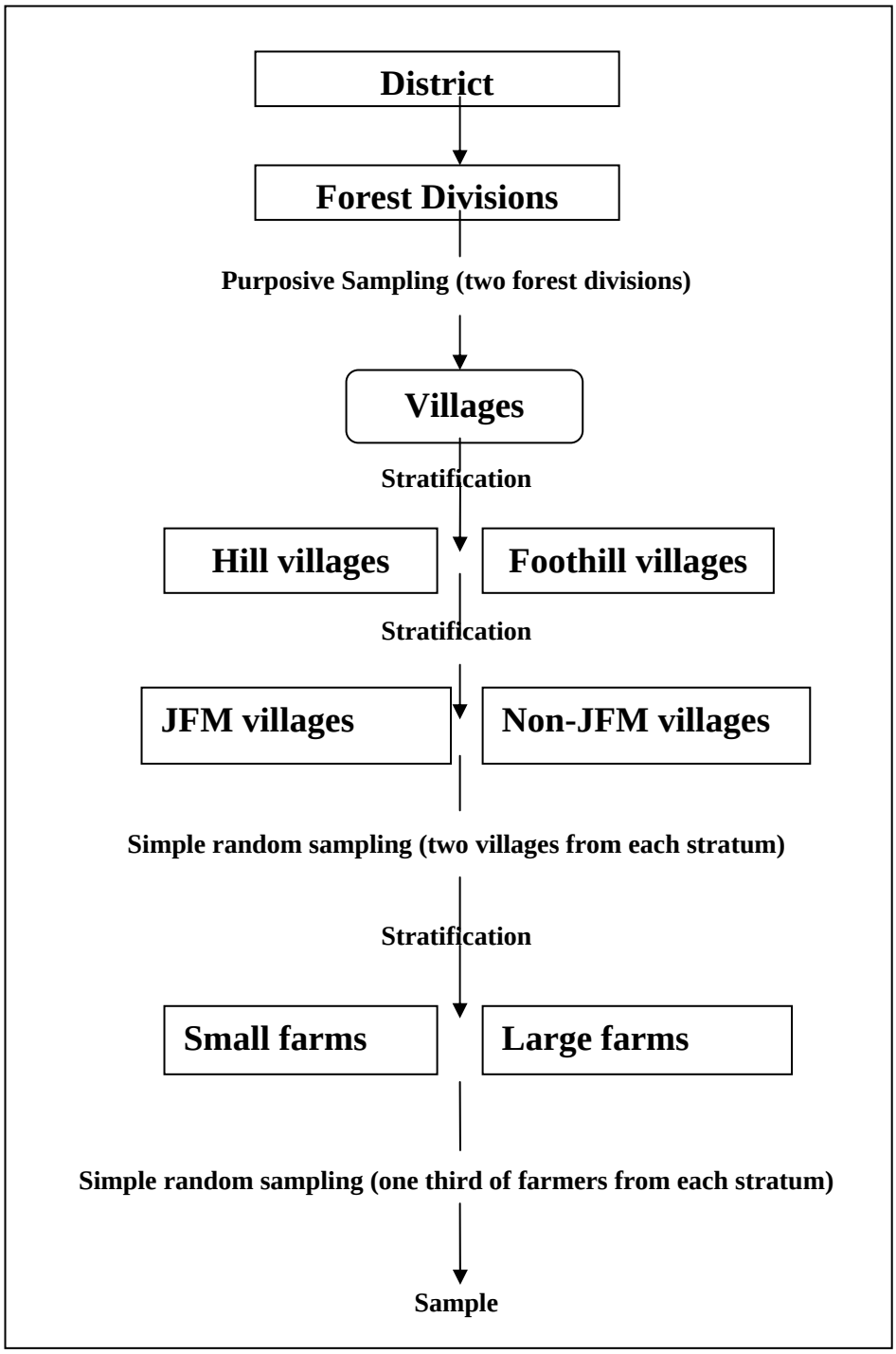


**Figure 1.** Stages of Sampling

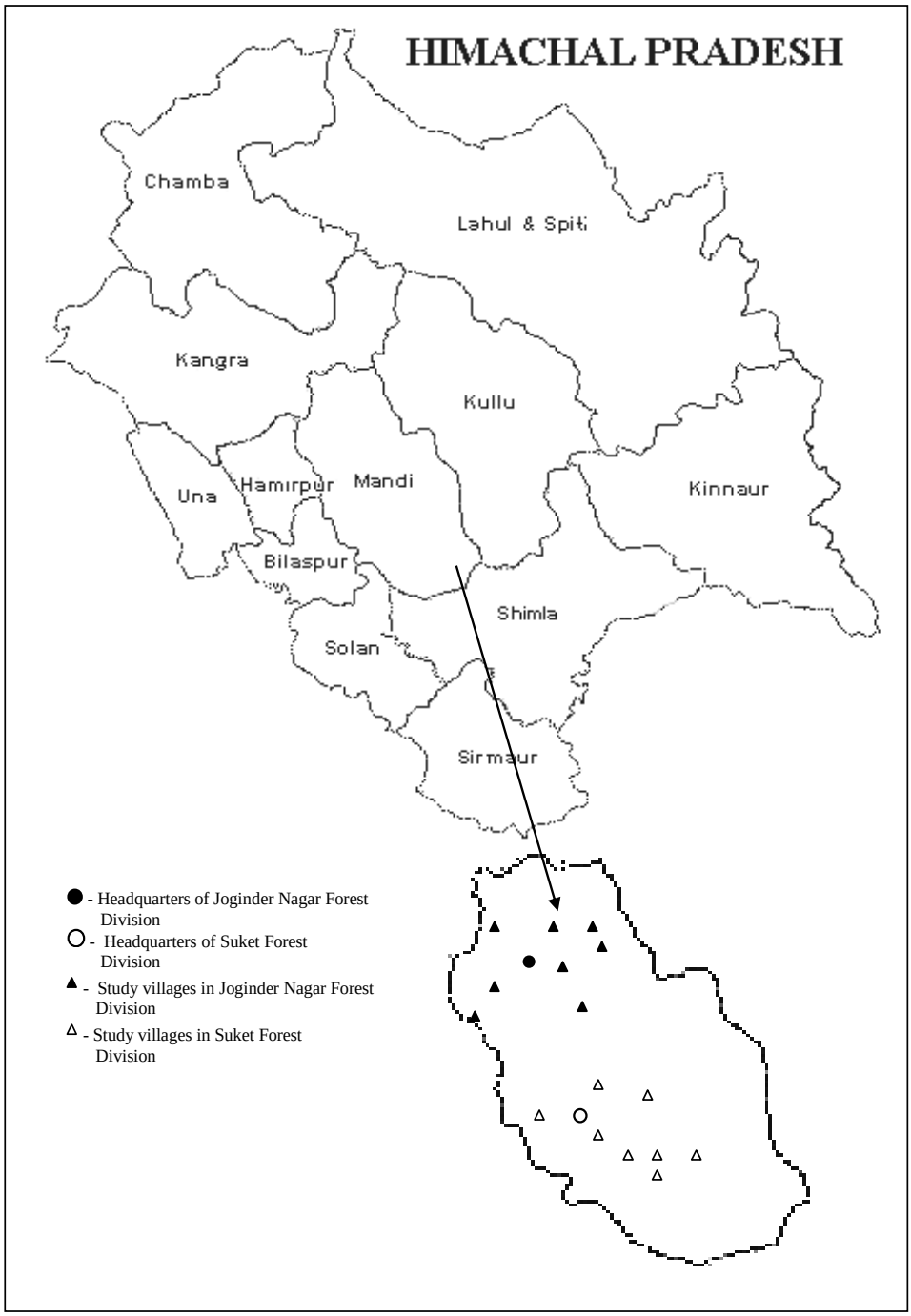


**Figure 2.** Location of Mandi District and the 16 study villages

Because data for number of trees per household did not follow a normal distribution, to test difference between numbers of trees per household across categories of independent variables, the non-parametric Mann-Whitney U test was utilised where there were two categories of independent variables and Kruskal-Wallis test was applied for more than two categories of independent variables. Median numbers of trees were taken as a measure of central tendency.

A critical significance level of 5% was adopted for association between independent variables on one hand, type of grower and number of trees per household on the other.

The central hypotheses for the household study were:

$H_{0:}$ There is no association between household perceptional factors and tree growing.

$H_{1:}$ There is an association between household perceptional factor and tree growing.

Tree growing included both the incidence and extent of agroforestry adoption.

## RESULTS

This section has been divided into subsections to describe separately the results on association of each socio-psychological factor with tree growing.

### Perceptions about Change in Forest Area around the Village

In traditional agroforestry systems, farmers might base their decision about whether to grow trees on their perceptions not only towards the trees on farm but also of the loss of forest area and the scarcity of tree products from forests. Different farmers perceived the change in forest area around the village differently in different villages (Table 1). Differences in perceptions arose for a number of reasons. For instance, perception of the increase in forest cover amongst farmers was due to the perception that plantations established by the Forest Department in the forests around the villages (irrespective of the survival of the species planted) and also enforcement of the ban on green felling, might have increased the area under forest. In many cases farmers perceived no change where a small decrease in an already thin forest or small increase in a dense forest had taken place.

Most farmers (91.7%) who perceived a considerable decrease in the forest area around their villages grew trees on their farms (Table 1). This indicates that these farmers might have responded to the perceived decrease in forest area by incorporating trees on the farm themselves. The proportion of farmers who grew trees on their farms was also over 90% in households perceiving a slight decrease in the forest area, but was lower at 85.4% and 76.8% respectively in the households perceiving no change and an increase in the forest area around their villages.

The median number of trees per farm exhibited no significant variation with perception of the farmers about change in forest area ($KW^2 = 1.405$, $p < 0.704$). The test result indicates that perception about the change in forest area was not a condition to motivate farmers to expand tree growing.

[2] KW is used here to represent the Kruskal-Wallis statistic.

**Table 1.** Association between tree growing and perception about change in forest area around the village

| Frequency | Perceptions about change in forest area around village | | | |
|---|---|---|---|---|
| | Decreased considerably | Decreased slightly | No change | Increased |
| Non-growers | 9 | 6 | 21 | 16 |
| Growers | 100 | 64 | 123 | 53 |
| Total | 109 | 70 | 144 | 69 |

Chi-square statistic = 9.839, D.F. = 3, $p < 0.020$, CFLF[3] = 0.

A Chi-square test between topographical location (hills and foothills) of the household and householder's perception about the change in forest area revealed a significant association ($\chi^2 = 72.098$, $p < 0.0001$). A higher proportion of the foothill households (39.7%) perceived a considerable decrease in the forest area compared to hill households (11%). The most probable reason was the higher population pressure on the forests in the foothills. The greater median return distance of the forest from houses and distance traveled to collect fuelwood in the foothills (7.5 km and 12 km respectively) than hills (1 km and 2 km respectively) would have also contributed to such a perception. Thus physical and economic scarcity of tree products might have contributed to a higher proportion of households in the foothills compared to the hills perceiving a considerable decrease in the forest area.

It is interesting to note that 32.9% of small farmers (with holdings of less than 1 ha) perceived a considerable decrease in the forest area around the village compared to 16% in farmers on larger holdings ($\geq$ 1.01 ha) ($\chi^2 = 13.946$, $p < 0.0001$). Small farmers have a lower capability to sustain their livelihoods and hence view a small decrease in forest area more seriously than large farmers.

**Perceptions about Change in Village Common Land**

Common land in villages includes any land other the forest land owned by government, and consists mostly of grasslands and pastures. The main reasons given during informal discussions for the decrease in area of village common land was that in some villages common land is used as an open access resource for grazing cattle; the titles (ownership) of these land parcels either have been transferred to the poor and landless for cultivation (known as *nautor*) or are illegally encroached by some villagers, particularly the elites, for cultivation of crops in localities of high population pressure. The majority of the farmers (52.2%) felt that there had been no change in the area under village common lands. The main reason was either that there were no landless to use common land or that the local community managed them traditionally – as happened in many villages – to grow grasses (which are harvested and stored for use in winter season) and consequently have not incurred the tragedy of the commons.

[3] CFLF refers to cells with expected frequency less than five.

The proportion of tree-growers was higher in households perceiving no change (80.4%) to those perceiving slight (89.0%) and considerable decrease (96.5%) in area of common land (Table 2).

**Table 2.** Association between tree growing and perception about the change in village common lands

| Frequency | Perceptions about change in area under village common land | | |
|---|---|---|---|
| | Decreased considerably | Decreased slightly | Remained same |
| Non-growers | 4 | 8 | 40 |
| Growers | 110 | 65 | 164 |
| Total | 114 | 73 | 204 |

Chi-square = 16.865, D.F. = 2, $p < 0.0001$, CFLF = 0.

The median number of trees per farm also varied significantly with the perception of the respondent about change in common land around the village (KW = 8.673, $p < 0.013$). The median numbers of trees were 50, 33, and 27 on the farms of the respondents perceiving a considerable decrease, slight decrease and no change in the area of village common land respectively.

A Chi-square test between topographical location of the household and householder's perception about change in area under village common land showed a significant association ($\chi^2 = 89.663$, $p < 0.0001$). A higher proportion of the households in the hills (79.6%) compared to the foothills (32.8%) felt no change in the village common land. In most of the hill villages, common village land is still managed traditionally by the villagers, which prevents conversion to agriculture. Although there was no significant association between perception about the change in the area of common land and type of farmers ($\chi^2 = 2.338$, $p < 0.311$), a higher proportion of small farmers (30.9%) reported a considerable decrease in common land compared to large farmers (25.2%).

**Perceptions about the Restriction on Felling Trees from Householders' Own Farms**

To avoid illegal felling from forests, rules and regulations control harvesting of wood and other tree products harvested from private farms in India (Koppelman *et al*. 1996). Moreover, the tree products can be sold, *de jure*, to the State Forest Corporation once in 10 years (Saxena 1991). However, many farmers, *de facto*, fell trees for their own use and sale (formal or informal markets) depending on the leniency of forestry staff and type of species. There are also exemptions on specific tree species from rules and regulation controlling their felling. Hence, the farmers' perceptions about the restrictions on felling trees varied depending on restrictions, *de facto* and *de jure*, on felling.

A higher proportion (98.8%) of tree-growers was found on farms where the farmer perceived no restriction on felling of the trees compared to the households with no idea (71.7%) and those who perceived a restriction (64.2%) on felling trees from own farm respectively (Table 3).

**Table 3.** Association between tree growing and perception about restriction on felling trees from own land

| Frequency | Perceptions about restriction on felling trees from own land | | |
|---|---|---|---|
| | No | Do not know | Yes |
| Non-growers | 3 | 15 | 34 |
| Growers | 250 | 38 | 61 |
| Total | 253 | 53 | 95 |

Chi-square = 86.002, D.F. = 2, $p < 0.0001$, CFLF = 0.

The median numbers of trees were 68, 12 and 6 respectively on the farms where the head of the household did not perceive any restriction on felling trees from own land, did not know and perceived a restriction on felling trees from private land respectively (KW= 121.894, $p< 0.0001$). There was a significant association between topographical location of the household and perception of the respondent about restriction on felling trees from own land ($\chi^2$= 114.379, $p< 0.0001$). A higher proportion of the farmers in the hills (48.2%) perceived a restriction on felling trees from their own farms than in the foothills (6.0%). This is because in the hills, most of the forestry tree species on the farms were the same as those of the nearby forest and were of high value hence attracting stringent restrictions to prevent their illegal felling. Moreover, no forestry tree species existing on the hill farms was *de jure* exempted from felling and transit rules. Almost all the forestry tree species exempted from felling and transit rules existed in the foothills.

**Perceptions about Restrictions on the Transport of Wood**

Like perceptions about restrictions on felling of on-farm trees, the perceptions about restrictions of transport of wood also varied with *de jure* and *de facto* restrictions on transport of wood, leniency of forestry staff to allow transit of wood, type of species, the type of transport (intra-village, inter-village or to towns or cities) and *de jure* exemptions from wood transit rules in certain tree species

The highest proportion of tree-growers (95.2%) was found in those households which expected a decrease in the level of restriction on the transport of wood in the future (Table 4). The lowest proportion of the tree-growers (79.9%) was found in households which perceived an increase in the level of restrictions on the transport of wood. There were 90.9% and 85.6% tree growers in the households with no idea and who perceived no change respectively in the level of the restrictions on the transport of wood.

**Table 4.** Association between tree growing and perception about change in the level of restrictions on transport of wood in future

| Frequency | Perceptions about restriction on transport of wood | | | |
|---|---|---|---|---|
| | Will decrease | No idea | Will remain same | Will increase |
| Non-growers | 5 | 6 | 14 | 27 |
| Growers | 99 | 60 | 83 | 107 |
| Total | 104 | 66 | 97 | 134 |

Chi-square = 3.323, D.F. = 3, $p < 0.004$, CFLF = 0.

The number of trees per farm also varied significantly with the perception of the householder about transport of wood in future (KW = 83.714, $p < 0.0001$). The median numbers of trees per farm were 131.5, 38.5, 33 and 13 on the farms where respondents perceived a decrease, had no idea, perceived no change and perceived an increase in the restrictions on the transport of the wood. There was a significant association between perception about restrictions on transport of wood in future and topography ($\chi^2 = 24.035$, $p < 0.0001$). A higher proportion of the households in the hills (42.9%) perceived an increase in the extent of the restriction on transport of wood in future compared to the foothills (26.6%). This was because most of the tree species in the hills were more valuable than those in the foothills thus attracting stricter *de jure* restrictions on their transportation. Perceptions might have also been based on the *de facto* experience with the restrictions on transport of wood as narrated by many farmers in the study area.

**Perceptions about Supply of Forest Products from the Forest**

In the survey areas, and particularly in hill villages (where commercial green felling was stopped and where most of the farmers are managing their forest traditionally), most of the farmers expected an increase in the supply of forest products (particularly fuelwood, fodder and timber) in the future as revealed by farmers during village profile studies. The proportion of the tree growers was higher (91.9%) in households who perceived a decrease in supply of forest products compared to those who perceived no change (89.7%) and an increase (70.1%) respectively in the supply of forest products from the forests. There were 90.9% tree growers on the farms who have no idea of the change of supply of the forest products from the forest (Table 5).

The median number of trees per farm was 51.5, 34 and 11 in decrease, no change and increase perceptional categories respectively (KW = 23.001, $p < 0.0001$). The median number of trees was 50 where farmers revealed no idea about future supply of tree products from the forest. This indicates that perception of the farmers about the future supply of tree products from the forest played an important role in influencing the extent of on-farm tree growing.

**Table 5.** Association between tree growing and perception about future supply of forest products from forest

| Frequency | Perceptions about future supply of forest products | | | |
|---|---|---|---|---|
| | Will decrease | No change | Will increase | No idea |
| Non-growers | 11 | 16 | 23 | 2 |
| Growers | 125 | 140 | 54 | 20 |
| Total | 136 | 156 | 77 | 22 |

Chi-square = 23.131, D.F. = 2, $p < 0.0001$, CFLF = 0.

**Perceptions about Change in Price of Wood in the Future**

The supply of tree products, mainly wood, has become restricted in terms of the volume available as well as the number of legal outlets for sale due to the ban on commercial green felling of trees in State Forests leading to a more rapid increase in price of tree products than most other agricultural commodities. Thus a household anticipating an increase in the price of wood in the future might be expected to reduce their expenditure on – or generate income from – tree products by growing their own trees for consumption or sale. There was no significant association between the proportion of tree growers and perception about future change in the price of wood (Table 6). This indicates that perception about change in price of wood is not a determinant of agroforestry adoption.

**Table 6.** Association between perception about change in price of wood and tree growing

| Frequency | Future price of wood | |
|---|---|---|
| | Will not change | Will increase |
| Non-growers | 14 | 38 |
| Growers | 106 | 233 |
| Total | 120 | 271 |

Chi-square = 0.400, D.F. = 1, $p < 0.527$, CFLF = 0.

The number of trees per farm varied significantly with perception about the change in the price of the wood ($Z^4 = 2.406$, $p < 0.014$). Surprisingly, the median number of trees was 44 and 29 on farms of the respondents perceiving no change and increase in the price of the wood respectively. This could be due to the fact that most of the farmers perceiving no change in price had a higher median farm size (0.80 ha) compared to those perceiving an increase (0.40 ha). There was a significant association between topography and perception of the farmers about the change in the price of the wood in the future ($\chi^2 = 4.268$, $p < 0.039$). Most of the farmers in the hills (63.6%) as well as foothills (73.4%) perceived an increase in the price of wood.

[4] The symbol Z is used here to represent the Mann-Whitney statistic.

This was related to the fact that most perceived that prices of most household items have increased and will continue to do so. There was a significant association between the type of the farmers and perception about change in the price of the wood in the future ($\chi^2 = 6.235$, $p < 0.013$). A higher proportion of the small farmers (73.2%) perceived an increase in the price of wood compared to large farmers (60.5%). This was because a small increase in the price was viewed more seriously by small farmers than large because of their limited capabilities to sustain livelihood.

**Awareness of Sources of Tree Seedlings**

In adoption of any farm practice, the awareness of sources of the inputs required for its adoption plays an important role (Parshad 1994). For cultivation of trees, knowledge of where to obtain seedlings is presumed to be one of the prerequisites. Those farmers aware of formal sources of the seedlings would be able to approach the right source to procure tree seedlings for planting on the farm and this could be expected to have a positive impact on tree growing. The awareness of formal sources of tree seedlings had no influence on tree growing in the present study (Table 7) in contrast to the findings of Sharma and Kumar (2000) in Haryana. The reason could be that farmers without any awareness of the formal sources of the seedlings also grow trees by retaining natural regeneration, sowing seeds or obtaining seedlings from their near-peers.

**Table 7.** Association between tree growing and awareness of sources of tree seedlings

| Farmer category | Aware | |
|---|---|---|
| | No | Yes |
| Non-growers | 7 | 45 |
| Growers | 43 | 306 |
| Total | 50 | 351 |

Chi-square = 0.054, D.F. = 1, p < 0.816, CFLF = 0.

The median number of trees per household also varied significantly across two awareness categories ($Z = 1.657$, $p < 0.098$). Hence it was concluded that source of the seedlings is not a necessary condition for tree growing in the study area.

**Attitude Toward Farm-Level Tree Growing**

The proportion of tree-growers was lower (66.4%) in the households with an unfavourable attitude compared to those with moderately favourable (93.8%) and highly favourable attitude towards agroforestry (98.7%) respectively (Table 8). This agrees with the findings of Daru and Tips (1985) who reported that participation in a watershed program (with tree planting as a component) in Central Java was highly correlated with attitude ($r_s = 0.892$)[5]. Sagwal (1993) also found that a favourable

[5] $r_s$ is the Spearman rank correlation coefficient.

attitude towards agroforestry increased the adoption rate of agroforestry program in Kangra (Himachal Pradesh) and Srinagar (Jammu and Kashmir), India.

**Table 8.** Association between attitude of the respondents towards agroforestry and tree growing

| Farmer category | Attitude | | |
|---|---|---|---|
| | Unfavourable (5-7) | Moderately favourable (8-11) | Highly favourable (12-15) |
| Non-growers | 42 | 7 | 2 |
| Growers | 83 | 105 | 149 |
| Total | 125 | 112 | 151 |

Chi-square = 68.956, D.F. = 2, $p < 0.0001$, CFLF = 0

The median number of trees per household also showed a significant change across attitude categories (KW = 137.255, $p < 0.0001$). The median numbers of trees were 7, 43 and 93 on the farms of the respondents with unfavourable, moderately favourable and highly favourable attitudes respectively.

In the present study, interestingly, there was a negative correlation between age of respondent and attitude of the farmer towards farm-level tree growing ($r_s = -0.260$, $p < 0.0001$), but mobility, education of the respondent and family literacy were positively correlated with the attitude of the farmer ($r_s = 0.661, 0.666, 0.624$; $p < 0.0001$ respectively). This might be attributed to younger farmers, particularly the more educated, having a culturally strong bias against manual work. Agriculture is more labour intensive than tree growing and therefore younger and more educated farmers would have developed a positive attitude towards farm-level tree growing. Parshad (1994) in his study of adoption of farm forestry in Haryana (India) also found a positive correlation between the attitude of farmers towards agroforestry and their formal education. Mobility might have increased the level of exposure to the outside world and to forestry contacts, and consequently might have favorably influenced the attitude of farmers towards tree growing.

## CONCLUSION AND POLICY IMPLICATIONS

Although only about one quarter of respondents perceived that restrictions apply on felling trees, this was the strongest perceptional factor stimulating adoption of agroforestry. The incidence of tree growing as well as number of trees per household were higher in households which perceived no restriction on felling trees from their own farm. This means that there is a considerable potential to increase incidence and extent of agroforestry adoption if efforts are made to raise farmers' awareness of *de jure* relaxations on felling on-farm trees announced by government to favorably change their perceptions about tree-felling restrictions. However, perceptions about the change in price of wood in future were not found to be a determinant for tree adoption. The perceptions about change in village common land, restrictions on transport of wood and supply of tree products from forests in future appear to be

strong psychological determinants of tree growing. The perceptions are based on situational factors like *de jure* and *de facto* rules and regulations controlling transport of wood. Therefore, efforts to make people aware of the *de jure* relaxations made by the government on transport of wood and the importance of forest resources, would facilitate adoption and extension of agroforestry. Perception about the change in forest area could not be regarded as a strong determinant because even households perceiving no change had a considerable proportion of tree-growers and this factor had no influence on the number of on-farm trees.

Attitude towards agroforestry was found to be the second most important determinant of on-farm tree growing in the present study. This means any attempt to develop positive attitudes to agroforestry would have a favourable impact on tree growing which can be achieved by increasing formal education and exposure of farmers to the outside world, particularly for older farmers who have a less favourable attitude but have the potential to grow more trees owing to their larger farm holdings. Old farmers can be encouraged to grow trees by changing their attitude towards agroforestry by demonstrating the benefits of agroforestry and exposing them to the outside world (demand-supply of tree products, rules and regulations and related relaxations on use of on-farm trees and services available to take up on-farm tree growing). The study has identified two areas which merit further attention. First, there is a need to take into account the socio-psychological factors of the farmers for planning socially acceptable agroforestry programs. Second, detailed study of various *de jure* rules and regulations controlling the use of on-farm tree resources and related exemptions and their association with farmers' perceptions and tree growing is required to suggest suitable changes to encourage tree growing.

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